those without FAI. No other significant differences were observed between the two groups.

Conclusions: These findings are consistent with the clinical presentation of those with FAI. Importantly, given that FAI has been implicated as a potential risk factor in the development of hip osteoarthritis, alterations in muscle and joint function due to the impingement may play a role in the breakdown of cartilage. Though previous studies have focused on strength or gait characteristics primarily in the sagittal plane, our findings indicate that deficiencies in all three planes of motion are exhibited in those with FAI. As a result, treatment strategies such as muscle strengthening or gait retraining should not be limited to hip extension or flexion.

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CHANGES IN PELVIS AND TRUNK POSITION ALTER KNEE JOINT KINETICS DURING SINGLE LIMB STANDING

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Purpose: To examine the effects of changes in pelvic angle and trunk position on knee joint loading during single limb standing balance trials.

Methods: Twelve (5 males, mean age = 29.9 +/- 5.5 years, mean BMI = 21.4 +/- 2.0 kg/m2) healthy individuals were recruited from the university community to take part in a single testing session. Participants performed a series of single limb standing trials, where they were asked to balance on their dominant leg with the contralateral knee bent to 90°. Two conditions assessing pelvic positioning changes on hip and knee kinetics were performed while balancing on one leg: (1) contralateral pelvic drop with trunk maintained in a neutral position (pelvic drop); (2) contralateral pelvic drop combined with trunk lean away from the stance limb (trunk lean). A third condition involving no modification of pelvis or trunk position (normal) was completed as a control condition. A total of three trials, each lasting three seconds, were performed for each condition, and the order of conditions was randomized. Kinematic data were collected using eight high speed digital cameras and the standard Helen Hayes marker set. Kinetic data were collected as the participant stood on a floor-mounted force platform. Kinematic and kinetic data were synchronized and used to calculate joint moments at the knee and hip. Outcomes included: knee joint loading as quantified by the external knee adduction moment (KAM) - a valid, indirect measure of medial compartment knee joint load, pelvic obliquity angle, ground reaction force knee lever arm distance, the mediolateral distance between the centre of pressure and the centre of mass (COM-COP), and hip adduction moment (HAM). The mean value for each outcome variable was calculated throughout each trial, and participant averages were obtained from the three separate conditions. Differences between conditions were examined using one-way analysis of variance (ANOVA). When significant differences existed between conditions ($p < 0.05$), the nature of each difference was further examined using Tukey's post-hoc analyses.

Results: Pelvic obliquity angle (contralateral pelvic drop denoted as a negative angle) differed significantly in the pelvic drop and trunk lean conditions compared to the normal condition ($p < 0.001$). Significant main effects existed for each outcome variable (see Table 1). Post-hoc analyses indicated that for all outcome variables, there were no significant differences between normal and pelvic drop trials, while trunk lean trials were significantly different from the other two conditions. Specifically, combined contralateral trunk lean and pelvic drop resulted in significantly larger mean KAM, lever arm, COM-COP, and HAM values.

Conclusions: These findings suggest that pelvic drop alone will not alter KAM magnitude, a risk factor for the progression of knee osteoarthritis. Pelvic drop, as a result of hip weakness, has been hypothesized to alter the centre of mass position with respect to the knee, resulting in an increase in the knee lever arm, and thus, an increase in KAM. Though studied in young and healthy individuals, the present findings do not support this proposed biomechanical mechanism. Instead, significant differences were only observed when contralateral pelvic drop was combined with lateral trunk lean away from the stance limb. These findings suggest that neutral alignment of the proximal segments may be beneficial for optimal distribution of joint load within the knee.

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THE EFFECT OF PROGRESSIVE STRENGTHENING PROGRAMS ON FUNCTION AND GAIT MECHANICS AFTER UNILATERAL TOTAL KNEE ARTHROPLASTY: A RANDOMIZED CLINICAL TRIAL.

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Purpose: Patients with unilateral Total Knee Arthroplasty (TKA) have functional limitations and abnormal walking patterns in which the non-operated limb is excessively loaded compared to the operated limb. Higher loading of the nonoperated limb puts the joints of that limb at a greater risk for osteoarthritis (OA) progression. The amount of symmetry between limbs in quadriceps strength is related to the amount of symmetry between limbs in knee flexion excursion during stance phase of gait. Therefore, it is possible that improving quadriceps strength symmetry might result in a concomitant improvement in biomechanical symmetry during gait, reduce loads on the nonoperated limb and potentially reduce the risk of OA progression. The purpose of this study was to compare the effects of a clinic-based rehabilitation program to a home-based rehabilitation program on quadriceps strength, physical function, and knee kinematics and kinetics during loading response phase of gait. We hypothesized that the clinic-based program would result in larger improvements in quadriceps strength symmetry, symmetry in knee kinematics and kinetics and larger improvement in physical function.

Methods: Twenty four subjects who were at least 6 months post unilateral TKA for osteoarthritis were randomly assigned to either a clinic-based program (N= 12, 50% women, Age:65.6±7.9 yr, BMI: 30.2±6.3) or to a home-based program (N= 12, 50% women, Age:65.5±9.3 yr, BMI: 31.1±5.1). The clinic and the home-based rehabilitation programs were impairment based programs to minimize impairments in joint mobility and muscle function with particular emphasis on improving the operated quadriceps strength. Patients completed baseline and post-intervention testing that included isometric quadriceps strength test and an assessment of physical function using the Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS), the timed up and go test (TUG), stair climbing test (SCT), and the six-minute walk test (6MW). Participants also underwent three-dimensional gait analysis. Mixed design ANOVAs were used to detect group by time differences in quadriceps strength, physical function, and knee kinematics and kinetics. Except for measures of function, ANOVAs were performed on symmetry indices quantified as the value of the operated limb relative to the nonoperated limb.

Results: Symmetry in quadriceps strength showed a significant time effect ($P<0.001$) with absolute increase of 17% and 9.4% in the clinic-based group and the home-based group respectively. Physical performance in the TUG and 6MW tests did not significantly change in either group ($P>0.4$). Performance in SCT showed improvement of 1.3 and 0.9 seconds in the clinic-based and the home-based groups respectively ($P=0.03$). Self-

Table 1
Main effects for outcome variables. Values are mean +/- SD.

	KAM (%BW*ht)	Pelvic Angle (°)	Knee lever arm (mm)	COM - COP (mm)	HAM (%BW*ht)
Normal	2.68 +/- 0.62	1.42 +/- 2.66	43.0 +/- 11.6	-2.87+/- 5.00	4.71 +/-0.73
Pelvic Drop	2.91 +/- 0.70	-4.89 +/- 2.55	47.5 +/- 13.0	-1.31 +/- 4.83	4.98 +/- 0.74
Trunk Lean	3.66 +/- 0.97	-4.51 +/- 2.13	61.3 +/- 15.7	7.22 +/- 5.41	6.18 +/- 1.38
p-value	0.011	<0.001	0.006	<0.001	0.002